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ABSTRACT

To ensure that the essential job-related reading materials for nonrated United States Navy personnel were not beyond their reading capabilities, a study was undertaken to determine the readability levels of a representative sample of essential Navy job-related materials. The criteria for selecting material were that it be narrative text and that it be encountered frequently by the nonrated sailor on the job or when studying for advancement in training. Ten text passages from each document were keyed into a computer and analyzed using the Computer Readability Editing System. Reading grade levels were computed for each of the text passages. These reading grade levels were then averaged to give a single reading grade level for each category of document, e.g., all rate training manuals. An average reading grade level for all categories of documents was also computed to establish the overall readability level of job-related material. Based on the results of the study, the following recommendations were made: (1) a ninth grade reading ability should be established as the minimum competency level for enlisted personnel, (2) remedial reading instruction should be provided for sailors reading below the ninth grade level as measured by the Gates-MacGinitie Reading tests, (3) Navy-relevant and job-related remedial reading programs should be implemented at apprentice training sites and at selected areas of fleet concentration, and (4) the readability of essential job materials with reading grade levels higher than 10.0 should be simplified. (HOD)

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TECHNICAL MEMORANDUM 82-6

READABILITY LEVELS OF REPRESENTATIVE NAVY JOB READING MATERIALS FOR NONRATED PERSONNEL

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Technical Memorandum 82-5

READABILITY LEVELS OF REPRESENTATIVE NAVY JOB READING MATERIALS FOR NONRATED PERSONNEL

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October 1982

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This study was conducted as part of the Navy's ongoing initiative in fundamental skills (reading, mathematics, and communication). Representative job reading materials for nonrated enlisted personnel were sampled to determine readability levels as information for establishing a minimum reading competency goal for enlisted personnel. The overall average for all material sampled (e.g., plans of the day, safety precaution placards, training manuals) was the 10th grade. (continued on reverse)

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20. ABSTRACT (continued)

Results from this study contributed to the formation of Navy policy set forth in OPNAV Instruction 1510.11, "Enlisted Fundamental Skills Training," of 19 August 1982, which establishes a reading competency goal of the ninth grade for all enlisted personnel.

The present study suggests an effort should be made to simplify the readability of the more difficult job reading material. At the same time, remedial reading programs for enlisted personnel with reading skill deficiencies should be implemented. These recommendations are consistent with Navy policy set forth in OPNAV Instruction 1510.11.

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SECTION I

INTRODUCTION

The Navy is becoming increasingly concerned about the need to ensure that, as the technical sophistication of military operations increases, duty-related reading demands are not beyond the reading capabilities of enlisted personnel. In an attempt to close the gap between the readability levels of Navy textual materials and the reading abilities of Navy personnel, the Navy is undertaking two major efforts: (1) methods for simplifying technical materials are being developed and tested and (2) remedial reading programs are being installed.

Representative of the first effort above, projects are underway for making Navy technical manuals more comprehensible to their target audiences and new page formats designed to improve technical documents have been published by the Chief of Naval Education and Training (CNET) (see for example, Braby and Kincaid (1981-82), NAVEDTRA 110A (1981) and Braby, Hamel, and Smode (1982)).

The second Navy effort is the current objective to establish remedial instruction programs at various stages of Navy training. OPNAVINST 1510.11, "Enlisted Fundamental Skills Training," (19 August 1982) directs the CNET to "define required competency levels for enlisted training courses..." and to "design and implement training programs to achieve competency goals...." Minimum reading competency goals for Navy training courses will be based on the reading requirements of the training materials and technical manuals currently used in the classroom and on the job. Reliable methods of obtaining quantitative measures of the readability levels of these materials, in terms of reading grade level (RGL), are currently available (for example, Kincaid, Aagard, and O'Hara, 1980).

The CNET tasked the Training Analysis and Evaluation Group (TAEG) to determine the current readability levels of various Navy technical materials.[1] Specifically, the TAEG was requested to analyze:

- essential job-related reading materials for nonrated Navy personnel
- course reading materials from a selected number of "A" schools.

PURPOSE

The purpose of this study was to determine the readability levels of a representative sample of essential Navy job reading materials for the nonrated sailor. The selection of sample materials was made by personnel in the TAEG, CNET, and the Recruit Training Command (RTC), Orlando, from materials employed in apprentice training and from documentation frequently encountered at duty stations and aboard ship. The outputs of this report

[1]CNET ltr Code N-53 of 13 July 1981

were to be utilized in establishing minimum reading competency levels for nonrated enlisted personnel in the Navy; preliminary data from this study contributed to the formulation of Navy policy contained in OPNAVINST 1510.11.

SECTION II

APPROACH

This section describes the methods used to obtain reading grade levels of essential Navy job reading materials for the nonrated sailor.

The approach involved the following steps:

- selecting representative reading materials to use in determining the average readability level of general Navy job materials
- collecting materials for readability analysis
- analyzing and summarizing the data collected.

SELECTION OF JOB-RELATED READING MATERIALS

The enlisted sailor is expected to read and understand reading material consisting of instructions, standards, training manuals and guides, plans of the day, and recording forms.

The criteria for selecting material for analysis were that it be narrative text and that it be frequently encountered by the nonrated sailor on the job or when studying for advancement in training. Given these basic guidelines for selection, suggestions of specific documents for inclusion in the sample were obtained from a review of the Bibliography for Advancement Study, NAVEDTRA 10052-AB (CNET, 1981), and from recommendations from TAEG, CNET, and RTC personnel. The sampling procedure for readability analysis was guided by the Department of Defense (DOD) Military Specification: MIL-M-38784A, Amendment 6.

COLLECTION OF MATERIALS FOR READABILITY ANALYSIS

A variety of sources were used to obtain samples of materials used in the readability analyses. To aid in this effort, the CNET officer in charge of Functional Skills Training Program Development (Code N-55) requested the Commander, Training Command, U.S. Atlantic Fleet (COMTRALANT) to obtain plans of the day from all ships under their command. Equipment operating procedures, rate training manuals and safety precautions (plastic safety placards) were obtained through supply channels. Materials appropriate to medical apprentice training were obtained from the Navy Regional Medical and Dental Centers.

ANALYSIS AND SUMMARY OF DATA

Ten text passages from each document were keyed into a WANG 2200 MVP computer and analyzed using the Computer Readability Editing System (CRES) (Kincaid, Aagard, and O'Hara, 1980). CRES has been used successfully to identify the RGL of reading materials. A recent example is the Submarine Warfare Officers School (SWOS) basic course (Aagard, Pereyra, and Kincaid,

1981). The RGL formula used in CRES is the DOD readability standard (Military Specification: MIL-M-38784A, Amendment 6).

RGLs were computed for each of the 10 text passages sampled from each document. RGLs for text passages were then averaged to give a single RGL for each category of documents (e.g., all rate training manuals).

After analyzing the samples, an average RGL for all categories of documents was computed to establish the overall readability level of job-related reading material for nonrated enlisted personnel.

SECTION III

RESULTS

This section summarizes the results of the readability analyses of the materials selected for this study.

Table 1 presents the 10 categories of job-related reading materials that were examined, together with the number of documents in each category, and RGL information. The categories are listed from high to low in RGL. Appendix A lists all documents analyzed.

TABLE 1. READING GRADE LEVEL (RGL) FOR CATEGORIES OF JOB-RELATED READING MATERIAL

Category of Reading Material	Number of Documents	RGL Mean	RGL Range
Navy Occupational Standards	2	14.2	11.1-14.8
Naval Performance Standards	5	12.0	9.4-16.5
Bluejackets' Manual	1	11.9	--
Personnel Qualification Standards	5	10.4	8.4-12.7
Apprentice Training Guides	3	10.1	8.0-11.4
Plans of the Day	7	10.1	--
Medical Apprentice Manuals and Guides	4	9.6	8.9-10.7
Rate Training Manuals	8	9.2	7.2-10.4
Propulsion Machinery Operating and Maintenance Manuals	3	8.3	6.1-10.4
Equipment Operating Instructions and Safety Precautions	38	8.2	4.0-16.7
All Categories	76	10.1*	4.0-16.7

*Weighted average based on the number of words in each sample.

Results of the analyses indicate a mean RGL of 10.1 for all texts sampled, with readability levels of categories of texts ranging from 8.2 to 14.2. The RGLs of individual documents range from 4.0 to 16.7

When the text categories are divided into Navy standards vs. procedural instructions as shown in table 2, higher reading grade levels are found for texts in the former category.

TABLE 2. KINDS OF TEXT CONSIDERED NAVY STANDARDS AND PROCEDURAL INSTRUCTIONS

Navy Standards	RGL	Procedural Instructions	RGL
Navy Occupational Standards	14.2	Medical Apprentice Manuals and Guides	9.6
Naval Performance Standards	12.0	Rate Training Manuals	9.2
Bluejackets' Manual	11.9	Propulsion Machinery Operating and Maintenance Manuals	8.3
Personnel Qualifications Standards	10.4	Equipment Operating Instructions and Safety Precautions	8.2
Mean	12.3	Mean	8.8

Procedural instructions have a mean readability level of 8.8 compared to a mean of 12.3 for Navy standards. This difference is statistically significant ($p < .01$).

SECTION IV

DISCUSSION AND RECOMMENDATIONS

This section discusses the results of the readability analyses of essential Navy job materials and presents recommendations concerning minimum reading competency levels for nonrated enlisted personnel.

DISCUSSION

The average reading grade level of 10.1 obtained for essential reading materials for nonrated enlisted personnel is middle high school level. This readability level is slightly higher than the 9.0 grade level specified for Navy technical manuals in DOD-STD-1685. However, the Navy commonly refers to another DOD source for readability standards, Military Specification: MIL-M-38784A, Amendment 6, which specifies that "technical publications shall be written at a Reading Grade Level (RGL) commensurate with the capability of the target audience for which they are intended" (para. 3.3.3, p. 11). The specification allows an overall grade level of no more than 1.0 above the appropriate RGL. The results of a recent study of reading abilities of 293 apprentice trainees tested at RTC, Orlando, indicated an average reading grade level of 9.5 (Brown and Kincaid, 1981). Thus, the present results and the results of Brown and Kincaid (1981) suggest that the assigned reading materials for nonrated sailors meet current DOD readability standards according to MIL-M-38784A, Amendment 6. Together, the two studies suggest a difference of less than one grade level between the average reading ability of nonrated sailors (9.5) and the job materials they are expected to understand (10.1).

The required reading materials, except for some documents containing Navy standards, should not present a problem to most nonrated sailors. Nonetheless, those sailors with reading grade levels below ninth grade can expect difficulty in comprehending required reading material from half of the categories sampled in the present study (those which are above 10th grade level).

Currently, a sixth grade reading level is the established minimum reading competency level for enlisted Navy personnel in recruit training. The Gates-McGinitie Reading Tests (MacGinitie, 1978), administered at initial entry, identify sailors who have RGLs below sixth grade. These recruits are given remedial instruction in the Academic Remedial Training (ART) program. A TAEG-developed remedial reading workbook, containing Navy vocabulary and Navy-relevant reading material, successfully augments the commercial non-military materials used in the program (Kincaid and Curry, 1979). Sailors leave the program with the reading skills necessary for successful completion of recruit training.

However, the readability levels of apprentice training and shipboard materials reported in this study suggest a sixth grade level is not enough to guarantee successful performance in the fleet. New learning objectives aimed at bringing sailors closer to the 10.1 grade level mandated by their required reading are desirable. A more realistic minimum reading competency level for all non-rated enlisted personnel is ninth grade. This conclusion

is in agreement with OPNAVINST 1510.11 which establishes a minimum reading competency of ninth grade as a "major goal of enlisted fundamental skills training...."

The remedial reading instruction necessary to accomplish the new objectives can be provided during apprentice training or at selected duty stations as self-paced training. If the instruction contains Navy vocabulary and reading matter from text categories listed in this report (table 1), the remediation will enable the sailor to understand typical reading matter assigned on the job. Then the instruction will help provide a minimum level of general reading competency and it will also teach job-related reading skills.

RECOMMENDATIONS

The following recommendations are based on the results of this study.

- establish a ninth grade reading ability as the minimum competency level for enlisted personnel (as has now been made Navy policy by OPNAVINST 1510.11)
- provide remedial reading instruction for sailors reading below the ninth grade level as measured by the Gates-MacGinitie Reading Tests
- implement Navy-relevant and job-related remedial reading programs at Apprentice Training sites and at selected areas of fleet concentration
- simplify the readability of essential job materials with RGLs higher than 10.0.

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MacGinitie, W. H. Gates-MacGinitie Reading Tests. Boston: Houghton-Mifflin, 1978.

Military Specification: MIL-M-38784A, Amendment 6, Department of Defense, 21 December 1981.

OPNAVINST 1510.11 Subj: Enlisted Fundamental Skills Training, Department of the Navy, Office of the Chief of Naval Operations, 19 August 1982.

Procedures for Instructional Systems Development, NAVEDTRA 110A, 1981. Chief of Naval Education and Training, Pensacola, FL 32508.

APPENDIX A

TITLES, REFERENCES, AND READING GRADE LEVELS OF ALL SAMPLED READING MATERIALS

The specific documents are listed under the categories defined in section II of this report. The RGL is given for each document.

EQUIPMENT OPERATING INSTRUCTIONS AND SAFETY PRECAUTIONS

Placard No.	Title	RGL
225-9200	Fire Indicating System	7.8
224-7500	Food Mixing Machine-Size 60	6.5
225-9700	General Alarm	5.6
224-8500	In Case of Drowning	7.2
225-2300	In Case of Gas Asphyxiation	7.4
221-3700	Abandoning Ship	7.1
222-5900	Microphone Instructions	5.2
222-2800	Navy Policy on Veneral Disease Prevention	9.2
224-0400	Dishwashing Machine	8.2
224-2500	Breathing Apparatus, Types A-1, A-2, and A-3	10.3
224-2900	Fixed Co_2 Fire Fighting Extinguishing System	10.2
224-3300	Portable CO_2 Extinguishers	9.1
224-7300	Ice Cream Plant	9.7
224-7400	Dough Mixing Machine	7.8
224-7800	Garbage Grinder	7.4
226-0500	Oil Fired Range	6.3
226-0600	Paper Cutter	6.3
224-2600	Self Aid in Case of Gas Attack	9.1

EQUIPMENT OPERATING INSTRUCTIONS AND SAFETY PRECAUTIONS (continued)

Placard No.	Title	RGL
221-5200	The Storage of Semi-safe and Dangerous Materials	16.7
226-0200	Meat Chopping Machine	7.0
226-1600	Starch Cooker	7.5
220-9600	Handling Carbon Tetrachloride	9.0
221-6100	Vegetable Chopper, Shredder, and Potato Peeler	8.4
221-6200	Bread Slicer	4.0
224-8000	Oxygen Breathing Apparatus (OBA)	4.2
226-5300	Prevent Laundry Dryer Fires	9.0
226-3400	Rescue Breathing- Mouth to Mouth, Mouth to Nose	5.7
223-5000	Roasting Oven	9.1
224-1700	CO_2 Fire Extinguisher	8.3
225-1100	Electrical Safety Precautions	9.5
224-1600	Entering CO_2 Voids or any other Unventilated Spaces or Compartments	10.9
224-4505	Men Working Aloft	7.6
224-4460	Paint Locker	6.8
224-2000	Damage Control Markings	10.4
225-8500	CO_2 Alarm	6.9
225-7100	Chemical Warface Agents	8.1
224-6100	Portable Water Motor Proportioner (Foam Liquid)	8.7
225-6100	Bailey Feed Regulators	9.3

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RATE TRAINING MANUALS

Title	Number	RGL
Constructionman	NAVEDTRA 10630-F	9.5
Fireman	NAVEDTRA 10520-F	10.2
Lookout Training Handbook	NAVEDTRA 389-01-00-79	8.7
Seaman	NAVEDTRA 101020-G	9.5
Tools and their Uses	NAVPERS 10085-B	7.2
Blueprint Reading and Sketching	NAVEDTRA 10077-E	10.4
Basic Machines	NAVPERS 10624-A	8.7
Airman	NAVEDTRA 10307-D	10.0

PLANS OF THE DAY

Command	Date	RGL
USS FORT SNELLING LSD-30	18 Sep 1981	-
USS FORT SNELLING LSD-30	17 Sep 1981	-
USS KIDD DDG-993	8 Sep 1981	-
USS SCOTT DDG-995	6 Oct 1981	-
USS SCOTT DDG-995	7 Oct 1981	-
USS SCOTT DDG-995	8 Oct 1981	-
USS VREELAND FF-1068	9 Oct 1981	-
		10.1*

NAVAL PERFORMANCE STANDARDS

Title	Number	RGL
Navy Equal Opportunity Manual	OPNAVINST 5354.1A	14.0
Military Requirements for Petty Officers 3 & 2	NAVEDTRA 10056-D	14.3
Basic Military Requirements	NAVEDTRA 10054-D	9.4
Military Requirements for Petty Officer 3 & 2	NAVEDTRA 10056-E	9.9

*All plans of the day were analyzed as a group.

NAVAL PERFORMANCE STANDARDS (Continued)

Title	Number	RGL
Department of the Navy Information Security Program Regulations	OPNAVINST 5510.1F	16.5

PERSONNEL QUALIFICATION STANDARDS

Title	Number	RGL
Material, Maintenance and Management (3-M)	NAVEDTRA 43241C	10.6
Navigation Plotter Recorder	NAVEDTRA 43492-2Q2	10.7
Final Qualification as a Lookout	NAVEDTRA 43492-201	12.7
General Damage Control	NAVEDTRA 43119-2B	8.4
Ship Control and Navigation	NAVEDTRA 43492-2	10.7

MEDICAL APPRENTICE MANUALS

Title	Number	RGL
Orientation to Medications	Education Services, Naval Regional Medical Center, Orlando, FL	9.2
Hospital Corpsman 3 & 2	NAVPERS 10669-A, 1967	10.7
Standard First Aid Training Course	NAVEDTRA 10091C, 1978	9.4
Dental Assistant, Basic	NAVEDTRA 10307-D	8.0

PROPULSION MACHINERY OPERATING AND MAINTENANCE MANUALS

Title	Number	RGL
Operator's Guide for Propulsion Machinery	NAVSEA LP-123-9010	10.4
Maintenance Procedures for Gate Valve	Fireman Apprentice-18492 (Rev. 1-80) Great Lakes	6.1
Maintenance Procedures for Gate Valve	Fireman Apprentice-16812(9080) Great Lakes	6.4

APPRENTICE TRAINING GUIDES

Title	Number	RGL
Fireman Apprentice Training Guide	FT/A18587 (Rev.12-80) Great Lakes	10.9
Airman Apprentice Training Guide	Recruit Training Command Great Lakes; 18264(12-80)	11.4
Seaman Apprentice Training Guide	Course Number X-777-7772 (10-80)	8.0

OCCUPATIONAL STANDARDS

Title	Number	RGL
Occupational Standards Apprenticeships	NAVPERS 18068	14.8
Occupational Standards: E2 through E4	NAVPERS 18068	11.1

MISCELLANEOUS

Title	Number	RGL
Bluejackets' Manual	Annapolis, MD: Naval Institute, 20th Edition	11.9

APPENDIX B

EXAMPLES OF TEXT ANALYZED BY THE COMPUTER READABILITY EDITING SYSTEM (CRES)

EXAMPLE 1. SAFETY PLACARD (NO. 0177-220-9600) (RGL = 9.0)

SAFETY PRECAUTIONS TO BE OBSERVED IN HANDLING CARBON TETRACHLORIDE

1. Prior to using carbon tetrachloride, permission shall be obtained from an officer who shall personally:

(a) Inspect the space in which carbon tetrachloride will be used for access and ventilation.

(b) Inspect the equipment to be cleaned.

(c) Insure that personnel are familiar with safety requirements.

2. Keep carbon tetrachloride stowed in spaces free of moisture and at moderate temperatures.

3. Make weekly inspections of spaces containing carbon tetrachloride to insure that cans are not leaking and that spaces are free of fumes.

4. Carbon tetrachloride shall be used for cleaning electrical equipment only. Its use for cleaning clothing is prohibited.

5. Avoid breathing fumes. If a person becomes overcome from fumes, remove him immediately to a well ventilated space and apply artificial respiration. Notify Medical Officer.

6. Carbon tetrachloride shall be used in adequately ventilated space only. Rig portable blowers as necessary. Have line on man and an assistant standing by outside with rescue breathing apparatus if required.

7. Keep containers tightly closed when not in use and in proper stowage.

8. Remember that the fumes from carbon tetrachloride are highly poisonous and will kill. The great danger lies in the fact that the effect is not noticeable by the victim and that he "passes out" without previous warning. Carbon tetrachloride can also be absorbed through the skin and into the blood stream with fatal results. If stowed in a warm location, it will decompose and form phosgene gas, which will cause immediate death.

9. These precautions shall be posted in the following spaces:

(a) Electrical Workshop.
(b) I.C. and Plot. Room.
(c) Electronic Workshop.
(d) Fire Control Workshop.
(e) Battery Shop.

EXAMPLE 2. OPERATING GUIDE FOR PROPULSION MACHINERY
(NAVSEA 0905-LP-123-9010) (RGL = 10.4)

GUIDE FOR LIGHT OFF AND WARMUP OF MAIN PROPULSION PLANT

The following schedule is a guide only. Actual light off and warmup shall be in accordance with Engineering Department and/or USS INCHON Instructions.

The ship is assumed to be in cold iron status with shore steam and electricity available.

Time Before Getting Underway HR - MIN	EVOLUTION
3 - 45	(a) Station steaming watch in Fire Room and Engine Room. (b) Set all clocks. (c) Remove stack cover. (d) Request permission from OOD to light off boiler number ____. (e) Ensure that bottom blow, surface blow, and header blow valves are closed. (f) Check safety valves to ensure that gags have been removed. Inspect hand easing gear. Lift as far as possible without opening valves. (g) Open the following valves; air cock, superheater drains, superheater vents, gage glass cutouts, and steam gage cutouts. (h) Oil king to test and treat boiler (if required) to upper limits. (i) Perform preliminary adjustments to the automatic combustion control (ACC) and feedwater control (FWC) systems to prepare them for subsequent operation.
3 - 30	(a) If boiler is full, drain to bottom of glass. Using auxiliary feed pump, fill to about 2 inches from bottom of glass. If boiler is empty, fill to about 2 inches from bottom of glass. When filling the boiler, open the economizer vent until water flows through the vent, then close valve. Duty Engineering Officer or Chief will witness water level. (b) Start forced draft blower, open air registers to vent furnaces. (c) Close individual atomizer and steam atomizer valves. (d) Line up fuel oil service pump suction and discharge lines. (Contact oil lab for fuel oil tank number.)

EXAMPLE 3. PLAN OF THE DAY (RGL = 10.4)

1. ESO NOTE: In looking through service records and in having experienced this recent examination cycle, it is apparent that there is a lack of communication concerning advancement and advancement requirements. Let me try to clarify a few points.

First, there exist no animal by the name of "Automatic Advancement". One must request and be recommended for advancement. Some of you have been an SR for more than required six months. If this is your situation request an advancement today.

The next point that I would like to make is that the BMR course is required for advancement to E-3. In addition, if you are not an "A" school graduate, you must complete either the Fireman or Seaman courses, as appropriate, and pass the E-3 examination.

My last point is that YOUR advancement is only partially the responsibility of ESO. The major responsibility of YOUR being advanced rests with YOU. Always remember however, ESO is here to help you.

2. DAMAGE CONTROL FITTING CLASSIFICATION

DOG ZEBRA (black D, red Z) - Assigned to fittings which must be closed for darkening ships which are not equiped with cutout (darken-door) switchs or light traps. The reason is to prevent light seepage outside the ship. They are also always closed during condition ZEBRA.

CIRCLE YOKE (black circle, black letter) - Assigned to special fittings which may be opened without special authority while proceeding to or from battle stations after General Quarters has been sounded. Other fittings so marked permit ammunition transfer and operation of vital systems. These fittings are open only when actually in use.

CIRCLE X-RAY (black circle, black letter) - Discussion same as CIRCLE YOKE except applying to X-RAY fittings.

3. FIRST CLASS MEETING

There will be a meeting of all First Class Petty Officers in the First Class Lounge at 1500 on 7 Oct.

4. CPO MEETING

There will be a meeting of all Chief Petty Officers in the CPO Mess at 1300 on 7 Oct, attendance is required.

Technical Memorandum 82-5

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